19-1032; Rev 0; 5/08

MAX1455 Evaluation Kit

Evaluates: MAX1455

General Description

The MAX1455 evaluation kit (EV kit) demonstrates resistive element sensor compensation and calibration using the MAX1455 and a computer. The kit includes an assembled and tested PCB, which is available with a factory-calibrated sensor (MAX1455EVKIT-CS) or without a sensor (MAX1455EVKIT-NS). The software and computer are not required for performing the initial performance evaluation of the sensor option since the EV kit is already compensated. A 10-pin ribbon cable connects the EV board to a serial-key adapter, MAX1452KEY, that plugs into a computer serial port, allowing the board to be evaluated inside an environmental chamber. The software requires a PC compatible with Windows® 95/98/2000/XP.

Windows is a registered trademark of Microsoft Corp.

Features

- **Proven PCB Layout**
- **Convenient On-Board Test Points**
- **Fully Assembled and Tested**
- **Optional Pressure Sensor (MAX1455EVKIT-CS)**
- **Factory-Calibrated Over Temperature (MAX1455EVKIT-CS)**
- **LabVIEW®-Based Software**

LabVIEW is a registered trademark of National Instruments, Corp.

Ordering Information

PART	TYPE
MAX1455EVKIT-CS	EV Kit
MAX1455EVKIT-NS	EV Kit
MAX1452KEY*	Serial Key Adapter

**MAX1452KEY is also used for MAX1455EVKIT and is included in MAX1455EVKIT package.*

EV Kit Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	470µF 10V electrolytic capacitor
C2, C4, C6	3	0.1µF X7R ceramic capacitors
C3, C5	2	1µF X7R ceramic capacitors
D1	1	5.6V Zener diode
D2	0	Dual diode, not installed
J1	0	2-pin header, not installed
J2	-CS	0 — 2-pin header, not installed
	-NS	1 — 2-pin header—shorted
J3	1	2-pin header
J4	-CS	1 — 2-pin header—shorted
	-NS	0 — 2-pin header, not installed
P1	1	10-pin header
P2, P3, P4	3	4mm banana sockets; connect +5V, GND, OUT
R1	1	10Ω ±5% resistor
R2	1	4.7kΩ ±5% resistor
R3	1	10Ω ±5% resistor
R4	1	30Ω ±5% resistor
S1	1	NovaSensor (Fremont, CA) NPH-8-100GH (8-pin TO package, 100kPa gauge)
S2	0	Unused, alternate sensor site
S3	1	8-pin DIL header, alternate sensor connector
SP1–SP4	4	Split pads; cut tracks to allow connection of sensor at S3
SP5	1	Split pad; configure on-board op amp as buffer; cut tracks to allow use of op amp
U1	1	MAX1455AAE
U1	1	MAX1455AAP

KEY Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	220µF 10V electrolytic capacitor (radial lead) Panasonic ECE-A1AKA221 Digi-Key P832-ND
C2, C3, C5	3	0.33µF ±10%, 25V X7R ceramic capacitors* (1206) Taiyo Yuden TMK316BJ334KF or equivalent Murata GRM319R71E334K
C4	1	0.047µF ±10%, 50V X7R ceramic capacitor (1206) KEMET C1206C473K5RACTU Digi-Key 399-1246-1-ND

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

KEY Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C6	1	10µF 10V tantalum capacitor (R case) Panasonic ECS-T1AX106R Digi-Key PCS2106CT-ND
C7–C12	6	0.1µF ±10%, 25V ceramic capacitors* (0805) Murata GRM21BR71E104K or equivalent
D1	1	Switching diode 30V, 0.2A Panasonic MA715-(TX) Digi-Key MA715CT-ND
D2	1	Diode BAR74 Zetex BAR74ZX
J1, J2, J4	3	2-pin headers, gold (0.1in centers) (cut from 36-pin strip) Sullins PZC36SAAN Digi-Key S1011-36-ND
J3	1	3-pin header, gold (0.1in center) (cut from 36-pin strip) Sullins PZC36SAAN Digi-Key S1011-36-ND
J1–J4	4	Shunts (J1 = open, J2 = shorted, J3 pins = 2/3 shorted (lower two pins), J4 = shorted) Sullins SSC024AN Digi-Key S9002-ND
P1	1	Low-profile header 2 x 5 0.1 centers 3M 2510-6002UB Digi-Key MHB10K-ND
P2	1	9-pin D-subconnector AMP 747905-2 Digi-Key A2047-ND
Q1, Q2	2	Power MOSFETs (8-pin SO) Fairchild NDS8958
Q3, Q5, Q6	3	npn transistors Panasonic UN5214 or UN5215CT
Q4	1	pnp differential transistor Panasonic XP2401
Q7	1	n-channnel MOSFET Zetex ZVN4106F
R1	1	1Ω 1W resistor (2512)
R2, R3	2	110Ω 1/8W resistors (1206)
R4	1	470Ω 1/8W resistor (1206)
R5, R6	2	47kΩ 1/8W resistors (1206)
R7	1	390kΩ 1/8W resistor (1206)
R8	1	10kΩ 1/8W resistor (1206)
R9, R10	2	2.2kΩ 1/8W resistors (1206)
RL1, RL2	2	Ultra-reed relays Hamlin HE3621A0510 Digi-Key HE207-ND
U1	1	Op amp (SOT23)* Maxim MAX4490AUK
U2	1	IC, hex inverter (14 SO) Texas Instruments SN74HC04DR Digi-Key 296-1189-1-ND
U3	1	Quad 2 input (14 SO) Texas Instruments SN74HC00DR Digi-Key 296-1187-1-ND
U4	1	RS-232 +5V driver/receiver* Maxim MAX3387ECUG
—	1	MAX1452KEY serial board, PCB

**Indicates that part is normally consigned by Maxim.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Digi-Key Corp.	800-344-4539	www.digikey.com
KEMET Corp.	864-963-6300	www.kemet.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Quest Components	626-333-5858	www.questcomp.com

⚠ **WARNING!** Do NOT interconnect the EV board and the KEY while jumper J4 is in place, as this will permanently damage the KEY when power is applied to the EV board.

MAX1455 Evaluation Kit

Quick Start

Required Equipment

- Precision-regulated +5V power supply
- Multimeter with at least five significant digits
- Sensor pressure source

Procedure

Use the following quick-start procedure to operate and evaluate the factory calibration accuracy of a MAX1455 EV board with sensor option.

1) Download and install the MAX1455 EV kit software on your PC.
2) Run Port98nt.exe (from the START menu or MAX1455 folder) to load the device driver for PC IO communication.
3) Connect a 5V power supply to the +5V and GND terminals on the EV kit.
4) Connect a DVM between OUT and GND.
5) Determine whether the EV board will run in analog or digital mode:
   Factory setting of the -CS type is analog mode.
   Factory setting of the -NS type is digital mode.
6) For analog mode, make sure jumper J2 is removed and jumper J4 is present. **Note:** It is not possible to communicate with the MAX1455 while in analog mode.
7) For digital mode, make sure that jumper J2 is present and jumper J4 is removed before applying power to the EV board. In addition, make sure that the 10-pin ribbon cable connects the EV board to the serial communication module and that the 9-pin connector on the serial module is connected to the PC either directly or through a straight-connected serial cable.

MAX1455 EV Kit Contents

The MAX1455EVKIT-CS is shipped fully temperature compensated from -40°C to +125°C. The MAX1455EVKIT-NS version of the EV kit is shipped without a sensor. Additional material may be included in your EV kit, which are not listed below.

- MAX1455 EV board
- MAX1452KEY interface adapter
- 10-pin ribbon cable for connecting the KEY and EV board
- Computer interface adapter ribbon interconnect cable
- Printout of compensation test data (MAX1455EVKIT-CS only)
- Five samples of the MAX1455
- Straight-connected serial cable for connecting the KEY and PC

Overview

The objective of the EV kit is to allow the user to learn how to program the ASIC using a hands-on approach. To do this, users are encouraged to compensate their own sensors using the EV kit along with the provided software. This kit is intended to be used by engineers familiar with resistive element sensors and their compensation techniques.

The purpose of the MAX1455EVKIT-CS is to demonstrate the capabilities of the MAX1455 in compensating a typical resistive element sensor. To assist the user in quickly evaluating the ASIC, the board has been precompensated using a generic, low-pressure sensor such as the NovaSensor NPH8-100G.

In the case of the MAX1455EVKIT-CS, the test data printout included in the EV kit is specific to the particular EV board enclosed in the kit. Both the test data and the EV board contain a serial number for identification.

Initial Setup

See the MAX1455 EV board (Figure 1). Four configuration jumpers, J1–J4, are provided to make the EV board adaptable to a wide range of applications. J1 bypasses the VOUT isolation resistor and is not normally fitted. J2 unlocks the MAX1455 digital interface and places the part in digital mode. J3 connects DIO to VOUT for single-pin programming. J4, when fitted, supplies power directly to the MAX1455. J4 must be removed when operating in digital mode as control of the power line is then provided by the serial-adapter board. Two rows of test points are provided to allow the user to probe the pins of the MAX1455, including the four sensor nodes. If the user wishes to connect an alternative sensor, this can be done using the 8-pin DIL socket, S3. When connecting an alternative sensor, the user must also cut the four split pad tracks (SP1–SP4) that connect the resident sensor, S1/S2. These pads are located on the reverse side of the board. The 10-way header P1 carries serial data and power to the serial-adapter board. This must be used when the MAX1455 is in digital mode and allows the user to reprogram the ASIC through the computer. Three 4mm banana sockets (P2, P3, and P4) carry the +5V, OUT, and GND signals to the board. Note that all the connectors and test pins are labeled on the board.

MAX1455 Evaluation Kit

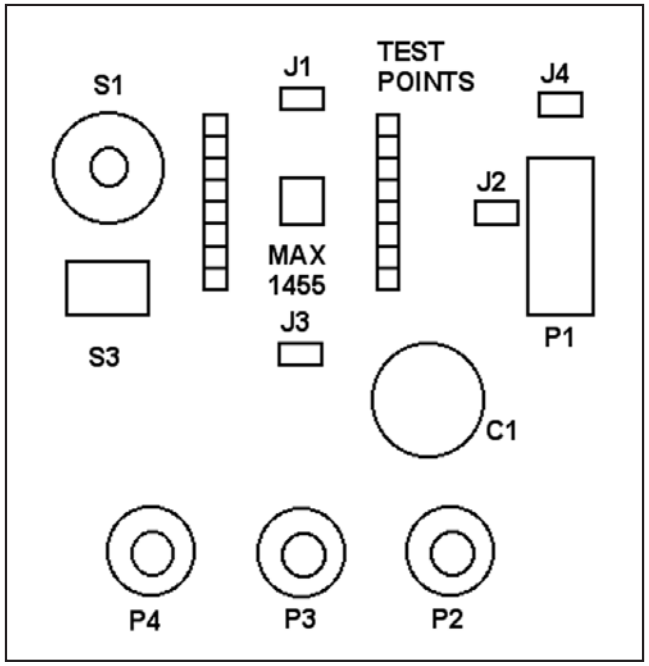

Figure 1. Evaluation (EV) Board Layout

Room Temperature Bench Test (MAX1455EVKIT-CS)

The board output is ratiometric to the supply, and therefore, a very accurate setting of the supply voltage is required to minimize measurement errors. Also, the board contains a Zener diode, which helps protect against overvoltage and reverse voltage. The protection circuit enables if the supply becomes less than approximately -0.7V or more than approximately +5.6V. The initial electrical connections should be made as follows:

1) Connect the negative terminal of the power supply to the 4mm banana socket labeled GND.
2) Connect the positive terminal of the power supply to the 4mm banana socket labeled +5V.
3) Connect the DVM to the 4mm banana socket labeled OUT; the ground return should be connected to the 4mm banana socket labeled GND.

IMPORTANT! To avoid problems with ground loops, noise, and to prevent possible damage to the MAX1452KEY adapter, connect all equipment including the computer (used later) to the same AC circuit and use one common earth ground.

If the power supply has a programmable current limit, set it to approximately 100mA. Adjust the supply voltage to +5V and measure the voltage at test point VDD with respect to test point VSS. At this point, there should be no connection to the sensor pressure port. Since the sensor supplied is a gauge type, the output voltage at the analog connector should read about 0.5V.

Carefully remove the plastic sensor protector (if supplied) and connect a silicone pressure tube to the sensor pressure port. **Grasp the sensor** (not the PCB) while fitting the tube in place. Perform any required pressure controller initialization/calibration procedures, then vent the system. The output voltage should read 0.5V. Perform a few pressure cycles to minimize hysteresis effects. Apply full-scale pressure as stated in the test data or as written on the back of the board, and confirm that the output reads 4.5V. The user can also test at other lesser pressures to check for pressure linearity errors.

Extended Temperature Pressure Test

Additional equipment required:

- Environmental chamber capable of -40°C to +125°C operation with a noncondensing atmosphere

The unit can now be tested at any temperature in the -40°C and +125°C range. It is advisable to first perform one or two full excursions of temperature and pressure to minimize hysteresis errors. It is recommended that the electronics be conformal coated in any application where condensation of moisture might occur. This was not done to the EV boards, since the user might wish to modify the circuit for specific requirements.

Since the PCB is not conformal coated, it is important that the environmental chamber not allow condensation to take place. If this should happen, a bake-out at +125°C (with no power applied) for a minimum of 1hr is recommended. Note that the circuit might behave erratically if moisture is allowed to condense on the PCB since weak ionic paths affect some high-impedance nodes on the board.

Most of the errors after compensation are due to the sensor's drift and nonrepeatable behavior. The EV board compensation printout includes the raw sensor output that was measured during compensation at each temperature. Users might wish to compare this data with their measurements of the sensor output in order to separate sensor errors from ASIC errors. This can be performed at the sensor connector. To avoid attenuating the sensor output signal, it is recommended to use a multimeter with an input impedance greater than 10MΩ for this measurement.

Important Note: Download factory-compensated coefficients into a file for future reference before overwriting flash content.

Computer Requirements and Connections

The next logical step after checking the module performance is to actually edit and reprogram the module using the same sensor. To do so, configure the EV kit for digital operation and connect the digital interface to the computer first. Below is a list of the computer requirements:

- IBM-compatible PC
- Windows 95/98/2000/XP
- One unused serial port

Detailed Hardware Description

The MAX1455 (U1) performs analog temperature compensation on piezo-resistive sensors. The MAX1455 contains the temperature compensation coefficients in its internal EEPROM.

Figure 2 shows the circuit diagram of the EV board. Figures 3–6 illustrate the PCB component placement and wiring details.

The MAX1455 has a single-wire digital interface that can be connected to the output to maintain a true 3-wire system. The MAX1452KEY interface adapter converts and buffers the outputs from the computer serial port to communicate with the ASIC. The adapter also controls power to the EV board when in digital mode. This configuration allows power resets to be performed under software control.

The adapter operates internally at 5V. The ratiometricity tests of the evaluation board should be limited to 4.5V to 5.5V while the digital connector is in place. This requirement is to prevent logic-level mismatch and the activation of any biasing protection diodes in the front end of the digital circuits.

Figure 7 shows the adapter circuit diagram and Figures 8, 9, and 10 provide PCB component placement and wiring information.

Replacing the Sensor (MAX1455EVKIT-CS)

The factory-calibrated sensor can be replaced by a user-provided sensor. It is recommended to become fully familiarized with the basic operation of the ASIC and the software before attempting to remove the sensor supplied with the board and replacing it with the user sensor. The MAX1455 works with 4-wire closed Wheatstone bridge-configured sensors. An 8-pin DIL socket is provided for alternative sensor mounting. The pinout for this connector is given in Table 1.

Table 1. I/O Connector S3 Signals Sensor Interface

PIN	SIGNAL	DESCRIPTION
1	OUT+	Positive output sensor
2	IN+	Top of Wheatstone bridge
3	OUT+	Positive output sensor
4	IN-	Bottom of Wheatstone bridge
5	OUT-	Negative sensor output
6	IN-	Bottom of Wheatstone bridge
7	OUT-	Negative sensor output
8	IN+	Top of Wheatstone bridge

Alternatively, the user can test the ASIC using an artificial bridge consisting of four discrete resistors. Some general knowledge of the user's sensor parameters must be known in order to set the initial coefficients. This way, the ASIC is not overloaded (i.e., output saturated). It is recommended that the sensor wires be kept as short as possible to minimize system noise. At this point, refer to the *Compensation Procedure* section in the MAX1455 user manual for a step-by-step procedure for compensating the sensor.

Calibrate the new sensor in a temperature-controlled environmental chamber.

EV Kit Software

An unused serial port on the host PC is required to allow software control of the MAX1455 EV board.

The MAX1455 EV kit software is an executable file developed using National Instrument's LabVIEW software. LabVIEW application is not required to run the EV kit software. The software is a high-level interface that calls a low-level serial.dll.

Note: The MAX1455 software tools can be downloaded and installed from the Maxim website at www.maxim-ic.com.

MAX1455 EV Kit Files

The software allows editing the contents of the ASIC's registers and EEPROM, as well as observing the effects of changes to the DAC on the output. Once desired results are obtained, the EEPROM can be programmed with the register contents.

Consult the MAX1455 reference manual for a more complete description of software operation and usage.

Below is a listing of the main files included in the EV kit software tools.

MAX1455 EV Kit Files

FILE	FUNCTION
MAX1455.exe	Communication program
Comp55.exe	Compensation program
read.me	Optional file containing last-minute additions
serial.dll	Low-level functional routines
port98nt.exe	Device driver for PC IO communication

Table 2. I/O Connector P1 Signal Digital Interface

PIN	SIGNAL	DESCRIPTION
1	GND	Ground return (screen)
2	VDDIN	Switched +5V return from serial board
3	VDDOUT	Switched +5V out to serial board
4	GND	Ground return (screen)
5	+5V	5V power input
6	GND	Ground return
7	+5V	5V power input
8	GND	Ground return
9	DI/O	Serial digital communications
10	GND	Ground return

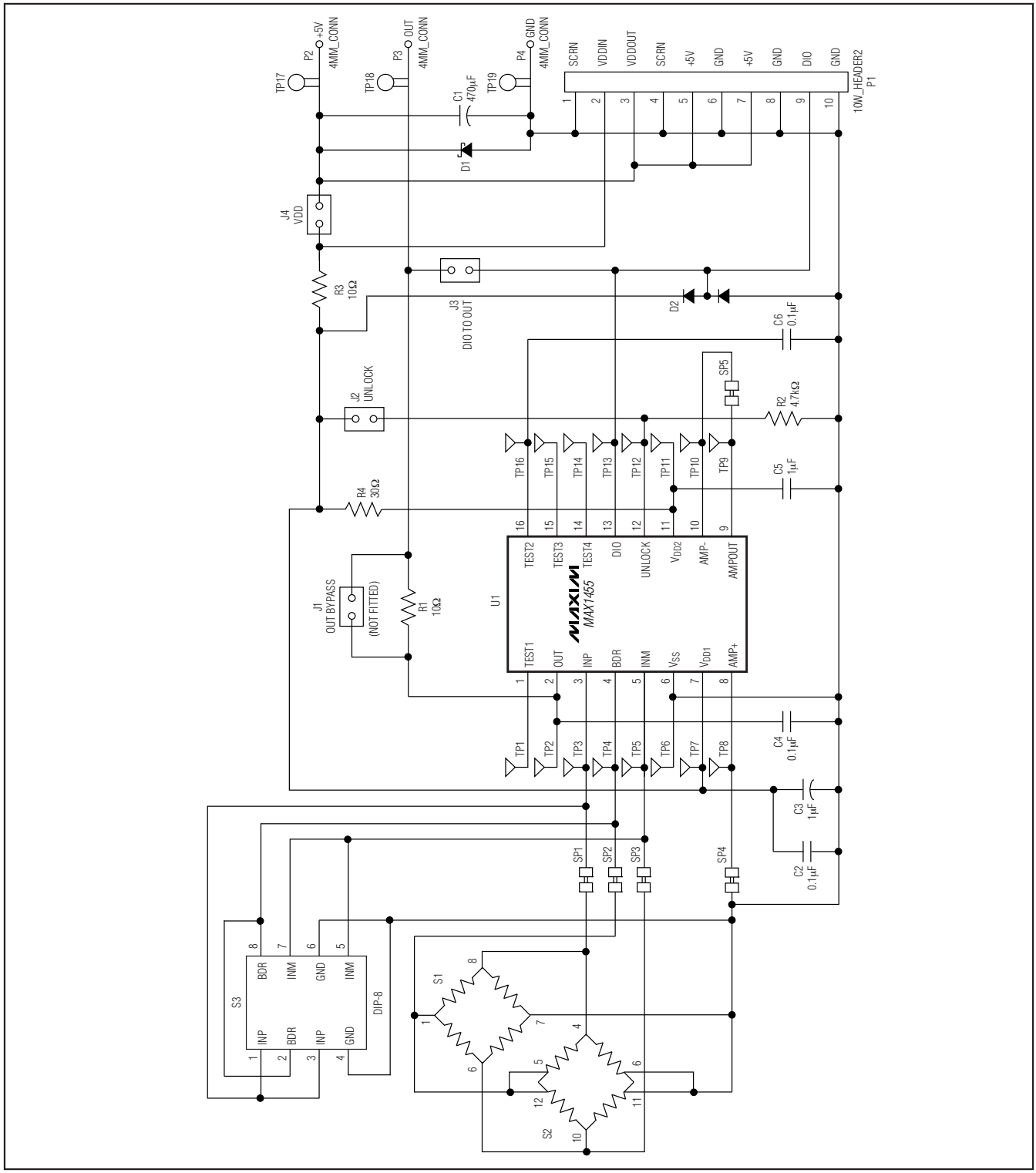

Figure 2. MAX1455 EV Kit Schematic Diagram

MAX1455 Evaluation Kit

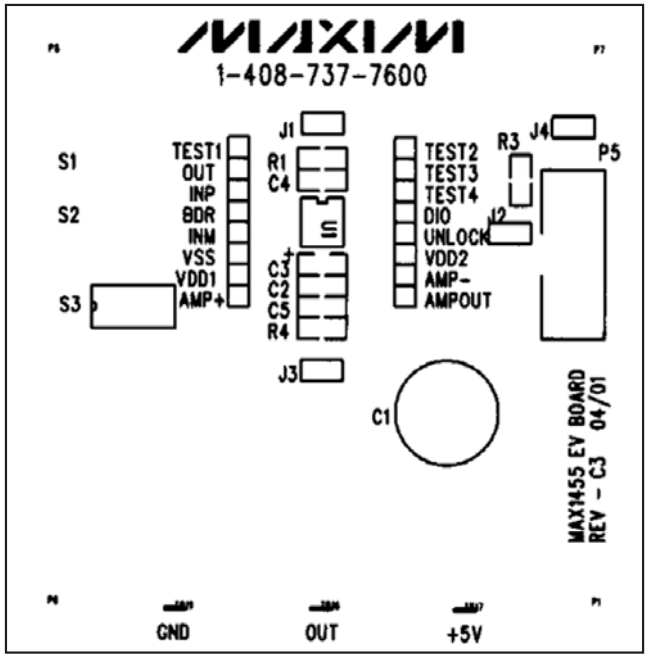

Figure 3. MAX1455 EV Kit Top Silk

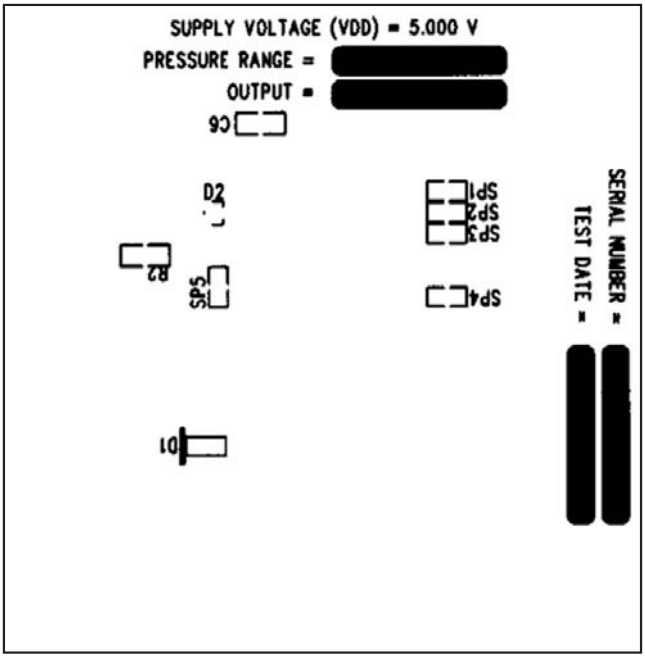

Figure 4. MAX1455 EV Kit—Bottom Silkscreen

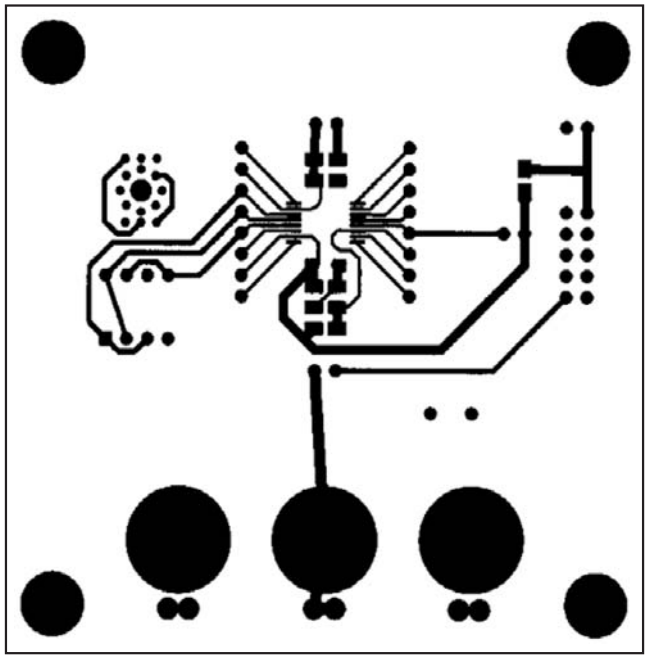

Figure 5. MAX1455 EV Kit—Top Copper

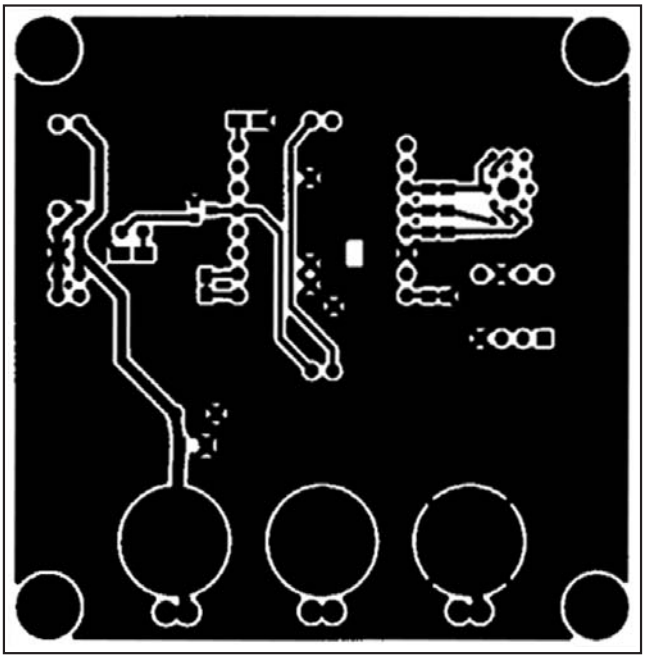

Figure 6. MAX1455 EV Kit—Bottom Copper

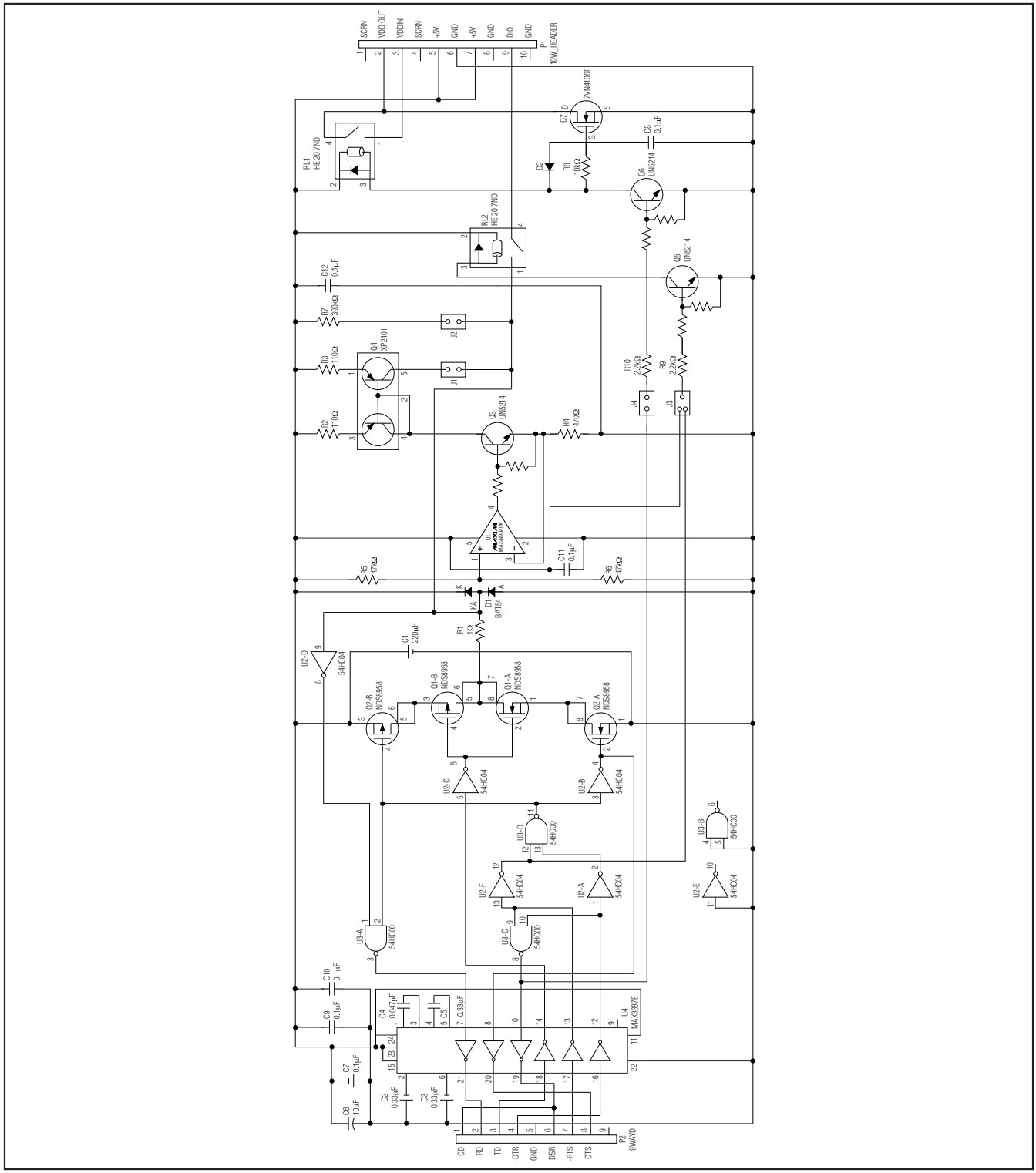

Figure 7. MAX1452KEY Adapter Schematic Diagram

MAX1455 Evaluation Kit

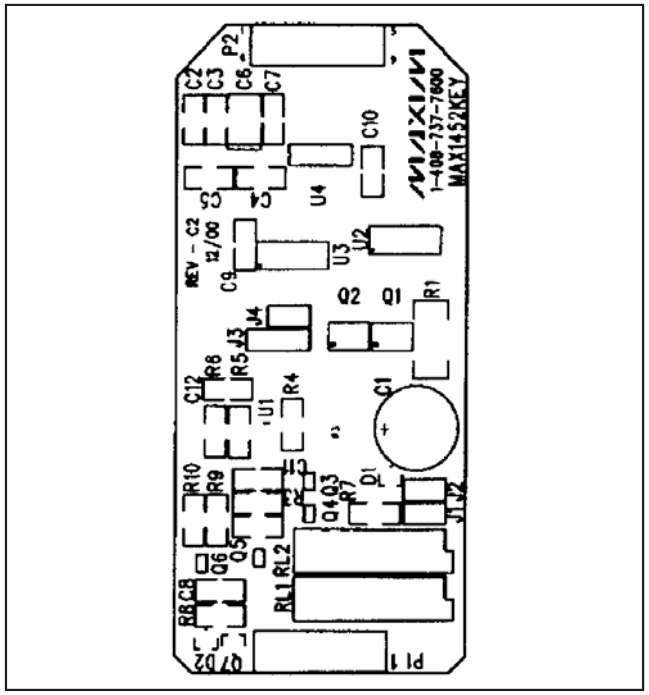

Figure 8. Adapter Circuit PWB—Top Silkscreen

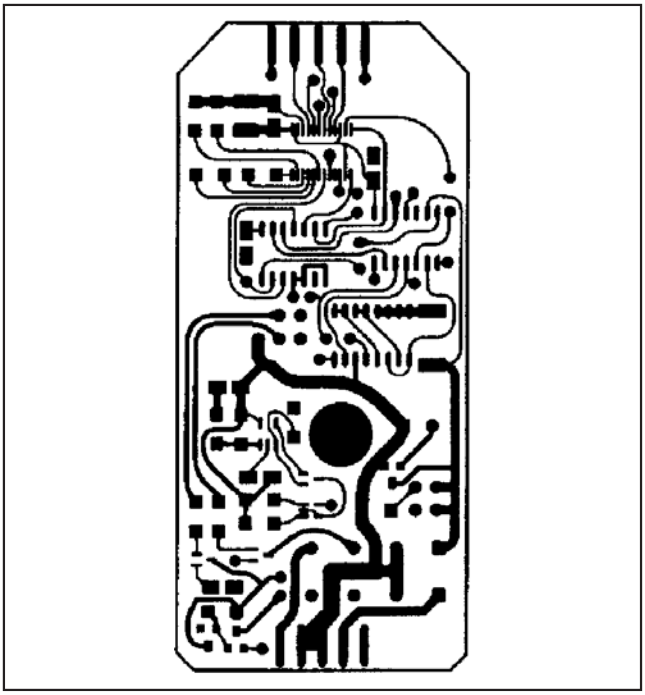

Figure 9. Adapter Circuit PWB—Top Copper

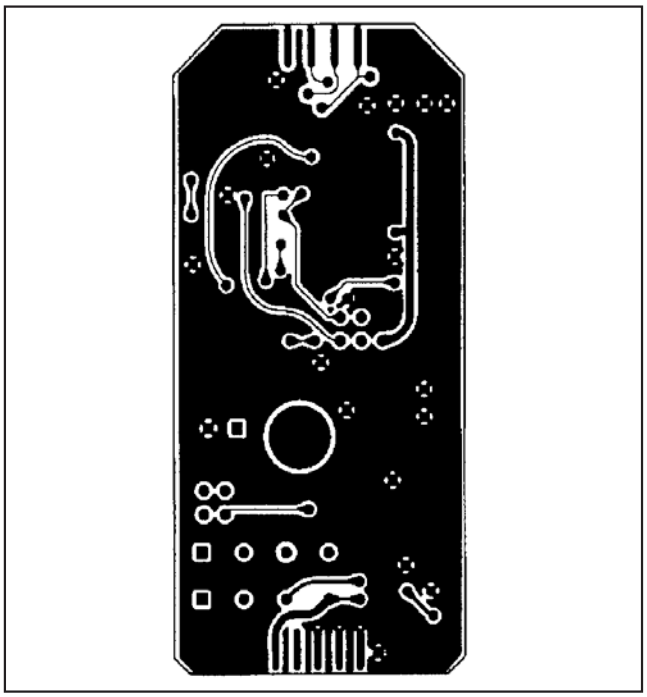

Figure 10. Adapter Circuit PWB—Bottom Copper

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